



## GENERAL REMARKS ON PROTECTIVE INOCULATION FOR BOVINE PLEURO-PNEUMONIA.

BY DR. OSCAR KATZ.

Having been requested by a Member of this Society at its last meeting to turn my attention to the movement that is going on in Queensland, and I may add, to no less extent in this country, as to the subject of protective inoculation for bovine pleuro-pneumonia at large, and a satisfactory and practical *modus* of such a procedure in particular, I have tried to put together in the following lines a concise general review of what may be gathered and followed from our knowledge about the subject in its present state.

Touching the history of the practice of inoculating cattle as a preventive treatment against lung-plague, or, as it is more commonly called, pleuro-pneumonia, I may mention that it was first introduced by Dr. Willems, of Hasselt (Belgium), as far back as 1852. To my knowledge it represents the first case in which a kind of vaccination was on a large scale applied to animals. Since that time an almost universal attention has been and is still directed to this specific prophylactic; there is, in fact, every reason for attempting to suppress and to get rid of this plague which at the present day is met with more or less in every part of the globe, and has involved and continues to involve most serious pecuniary losses. For instance, since the supposed introduction of the disease into Australia in 1858, the damage caused by its devastation and by the measures employed for mastering it, amounts to something enormous. Queensland alone which possesses about four million

head of cattle, that is nearly as much as the other Australian colonies together, is estimated to have participated therein to the extent of £5,000,000, and the annual losses entailed are calculated to be about £500,000.

In looking at the position which protective inoculation for this cattle disease occupies at present in those countries where the latter is prevalent, and the rearing and preservation of stock a matter of vital importance, we find that most of them are in favour of this treatment being adopted. These are principally : Scotland, Belgium, The Netherlands, France, South Africa, and last but not least, the Colonies of Australasia. I may be permitted to quote some figures. As the result of an official inquiry in 1875, into the state of preventive inoculation for pleuro-pneumonia in New South Wales, it turned out, that a strong majority of graziers pronounced a favourable verdict. Of 282 cattle-owners who were in the habit of inoculating, 234 were favourable, 19 opposed to the measure, *i.e.*, in proportion 12 or 13 for, to 1 against it, while 11 entertained doubts, and 7 stated nothing. Among 272 owners who did not practise inoculation, 54 were for, 50 against, 13 being doubtful, and 155 offering no opinion.

These figures, supporting so decidedly as they do, inoculation, claim our full consideration, so much the more as some of the operators must undoubtedly have encountered greater difficulties in carrying out the operation than there would have been, could it have been performed by experienced veterinarians, or perhaps under more favourable circumstances. Thus the prospect of success must, after all, have been smaller in the former case than in the latter.

But still the method of inoculation has its opponents, who rather incline to the adoption of other preventatives such as the so-called "stamping-out system." In one point, however, there seems to be a general agreement, namely, that a cure of the disease

is altogether objectionable from a practical standpoint as well as from an economical one, and that consequently, all therapeutics have to be thrown overboard. Nothing then remains but the employment of prophylactic measures, of which protective inoculation is one. We have now to enter upon a consideration of the nature of this subject, and to see whether the results of such a consideration can be brought into harmony with the seemingly favourable results claimed by the advocates of the system.

The notion "protective inoculation" in connection with any disease, hence also in the cattle disease under notice, presupposes that it belongs to the group of infectious diseases which by means of a "contagium," are capable of transmission from individual to individual, at least under certain circumstances. That bovine pleuro-pneumonia is one of this kind, or in other words, that it presupposes a contagium in the shape of an organised something, of a microscopic being, is regarded as a settled question, to judge from the present standpoint of science, and from practical experience. For a full understanding of the disorder, as well as for the mode of combating it (taking special reference to protective measures), it must, however, appear very important to know at the very outset, how the disease spreads. There are two principal possibilities. (1) It may be caused by germs which represent so-called *obligate* parasites, that is to say, which for their propagation need the body of cattle (or perhaps of some other animals). These germs again might be of two descriptions. On the one hand they might lose their power of infecting by having been exposed to external agencies, thus resembling, as it were, the pathogenic factors in human syphilis, in regard to which we are compelled to accept the view that it cannot be communicated but by immediate contact. On the other hand they might also, after having left the animal body, but if so without being able to propagate, possess the faculty of infection. An instance of such a kind we have in

tuberculosis, the microbes of which represent the vehicles of both direct and indirect infection, the latter taking place by germs (their spores) which exist in our surroundings, and hold out there for a considerable length of time. (2) The disease, as such, might be attributed to so-called *facultative* parasites, *i.e.*, micro-organisms which feed, multiply, and may form resting stages on or in various dead organic substances, but transferred to the living animal body manifest themselves as parasites. The best known instance of such a case is furnished by *anthrax* or *splenic fever*. The pathogenic agents of this infectious disease, the *anthrax* bacilli, are not necessarily bound to live in animals or in man; on the contrary they are originally harmless saprophytes, but, when occasionally gaining access to the blood-system of living beings, they unfold a most pernicious activity.

It is evident that a decision of which of the above conditions is fulfilled with regard to bovine pleuro-pneumonia, must have a legitimate bearing on the question of the kind of protective means to be adopted against the disease. If this is inaugurated after the manner of syphilis, and therefore, the scope of its spreading very much limited and easily traceable, then it would be most questionable whether some preventive vaccination should be preferred to other prophylactics. If on the other hand there are far more dangerous doors open to the propagation of the disease, and if we have reason to suppose that it depends on a contagium like that of tuberculosis or of splenic fever, then, of course, the subject of protective inoculation claims a greater interest.

Unfortunately our knowledge of the exact manner in which pleuro-pneumonia makes its appearance and spreads, is as yet far from being certain; nor are we warranted in arriving at a satisfactory answer so long as the causal factors of the plague are not yet thoroughly recognised and their biological properties studied. What we may gather from practical observations is not sufficient

for a final decision, since opinions differ widely as to that point. Yet we are warranted in saying *a priori* that, in a similar way as it has been pronounced by von Pettenkofer for epidemic cholera, the outbreak of an epidemic of pleuro-pneumonia must have been preceded by an infection *en masse*. Infection of this description could best be brought about by micro-organisms of the type of *facultative* parasites (see above). In epidemics of anthrax and of typhoid fever we cannot but trace such a course of things ; besides, the statistic observations on the mode of spreading of cholera, anthrax, and typhoid-fever, are altogether in concordance with the results of laboratory experiments on the infectious matter of these diseases. On pleuro-pneumonia we fail to bring to bear such powerful help ; for it is premature in this direction to draw definite conclusions from the results of investigations by Poels and Nolen, who have designated a certain micrococcus as the *vera causa* of that bovine disease (*The Veterinarian*, March 1887, pp. 143-157). In the interest of the matter itself their experiments require expansion, and the results as yet obtained corroboration.

Returning after this digression to our subject proper we must try to obtain a definite view of its essential characters.

In its present shape protective inoculation for bovine pleuro-pneumonia occupies a peculiar position among the other modern inoculations or vaccinations. It is a matter *sui generis*. The procedure is as follows : when the disease is stated to be present in a herd, the *vaccin* is procured by killing one or more of the sick individuals, and collecting the *serum* out of the diseased lungs, or the pleural exudations. A definite portion of such liquids is then transferred—the *modus operandi* differs—to the subcutaneous connective tissue near the end of the tails of healthy, or we have reason to add, apparently healthy individuals. This operation gives rise to a localised swelling which is considered to be a repetition in a milder form of what takes place in lungs and pleuræ in the

virulent form of the disease. After this local affection is over, the animals are said to be proof against lung-plague.

From this generalising report on the mode in which protective inoculation for the cattle-disease under treatment is being practised, you will at once perceive its peculiarities. Take as object of comparison the ideal of the modern preventive inoculations, vaccination against variola. Vaccination in the human species is admittedly followed by the intended result only when it is carried out before the disease (variola, small-pox) has taken possession of the individuals that are to be protected. It is a genuine preventive treatment which will not admit of the incursion of the disease. The same principle is adhered to in the preventive inoculations for certain animal plagues, for anthrax or splenic fever in sheep and cattle, for symptomatic anthrax (or "black-leg" or "quarter-ill") in cattle, for fowl-cholera, and swine-fever. In all these cases the employment of the preventive precedes, must precede the appearance of the respective disorder, and not the other way. The ordinary method of protecting cattle against "pleuro," however, does not always seem to be guided by that principle. We have briefly mentioned that inoculation will be performed after the plague has already commenced its work. This being the case we are well justified in assuming that, besides quite normal and healthy individuals, some, be they few or many, which have already taken up the virulent agents of the disease, will be inoculated. Such an event could have occurred without having set up any reliable symptoms. It must be remembered that, the auscultation of a bovine chest being in itself no easy task, especially for non-experts, the difficulties must accumulate when a cattle-owner has to inoculate, say, 1,000 head. The risk of inoculating individuals already but imperceptibly infected, is moreover enhanced by our not knowing anything exact about the period of incubation, and the precise course of the disease. Yet it would appear as if the period of incubation is

subject to considerable fluctuations, thus rendering the question of making a correct diagnosis a matter of considerable embarrassment. In view of such facts, the above factor in connection with inoculation for "pleuro" is pre-eminent; it must be looked upon as a very strong objection to the measure in its present state, unless experiments can show beyond every doubt that immunity through inoculation is also bestowed upon such animals as are already infected. Otherwise the manipulation, instead of preventing the disease from spreading, would tend to preserve and propagate it, by allowing vaccinated but previously affected individuals to pass as being safe. It is true that in the most modern protective inoculation, namely Pasteur's treatment of hydrophobia, we find an instance which seems to correspond to a postulate of the above kind. Pasteur applies his method not until his patients have been bitten by a rabid animal, and, consequently are already impregnated with the deadly virus. For the present, however, it is advisable to view with some reserve Pasteur's results so far as rabies is concerned.

Another point that calls for our attention is this. How is it that in pleuro-pneumonia the material to be inoculated has the shape of a virus, taken directly from the diseased organs, and in this condition applied to the subcutaneous cellular tissue of the tail, that is to say, to spots which have nothing to do with the chief seats of the malady? With one exception (see below), there is no analogy to this extraordinary case in the other protective inoculations which have been made known. Here *vaccins* are used which although morphologically very similar to, or, as a rule, quite the same as the virulent agents, are weakened, partly naturally, partly artificially, to such a degree that they are no longer able to kill the individual species for which they are intended. The vaccine-lymph for small-pox vaccination represents the virulent material of vaccine or cow-pox, but such a material or, if you like, bacterial life and its products, although extraordinarily alike to



that of variola or small-pox, cause, when transferred to man, only slight alterations, after which any attack of the virulent factors of this disease will be frustrated. With regard to protective inoculations of animals we may take as example that of anthrax. Here the generally used cultures of micro-organisms are attenuated by means of higher temperatures, so as to have lost their power of infecting, while at the same time their morphological characters do not differ from those of the virulent bacilli. Experience has further shown that the inoculation-material prepared in the described manner, must enter into a communication with those organs or tissues which are the principal seat of the disease present, and in which they have to call into existence symptoms, analogous to those exhibited in the virulent form of the disease, but only modified and often scarcely perceptible. The attenuated anthrax-virus is transmitted through the subcutaneous connective tissue to the blood, which is the seat of splenic fever.

Nothing similar seems to take place with reference to protective inoculation for pleuro-pneumonia. In this case both the kind of virus employed, and the part of the body where it is applied, are altogether contrary to those facts. There is, however, one cattle-disease, namely symptomatic anthrax ("quarter-ill," "black-leg"), in which we find something analogous to pleuro-pneumonia. With regard to the former it has been proved beyond doubt that, by means of direct injections of unweakened virus (*e. g.* sap of diseased muscles) into the veins of healthy individuals, these can be rendered immune, although the blood-system as such is not the place where the contagium of the disease (the symptomatic anthrax bacilli) settles, and carries on destruction. (The usual way, however, in the practice of inoculation against this plague, is by means of artificially weakened virus, applied subcutaneously). It stands to reason that the same may possibly hold true with the mode of protection against pleuro-pneumonia, for a liquid carrying the infective matter in the shape of microscopic organisms, has, if inoculated underneath the skin, every chance to be taken up by the blood, and thus carried to the lungs and other organs. But in



symptomatic anthrax we have a well-studied disease, the etiology of which is perfectly known. Not so in bovine pleuro-pneumonia. For this reason we have to be careful not to generalise without further information, and it must rest with future researches to decide upon this hitherto dark question in the mode of inoculation against pleuro-pneumonia.

Even if, for the sake of argument, we admit that inoculation against pleuro-pneumonia in the customary shape does protect, we are not yet thoroughly informed as to how long the protection will last. This is, of course, an important factor, which must necessarily influence the discussion of the whole question. Human vaccination is known to bestow a long-continuing immunity, and re-vaccination is held to be a powerful aid in securing the intended effect. The question of the period of immunity after inoculation against animal-plagues, is as far as we know, more uncertain than in the case of human vaccination. For instance, the protective power of anthrax-inoculation in sheep extends to about one year, while for cattle the period of protection is as yet uncertain. Such an uncertainty has, among other things, rendered the last-mentioned kind of inoculation, and others objectionable, and it is, therefore, not to be wondered at, if the present practice of inoculation against "pleuro" is for the same reason judged in a similar manner.

In addition to the above statements I must point out in a few words that opinions do not agree as to whether inoculated animals are able to infect uninoculated ones or not. This point, of course, is one of paramount importance, and if it could be unmistakably proved that the inoculation in its present shape can yield the means of infection to unprotected individuals, the whole procedure must appear in a most doubtful light. Now, what might happen if a herd of fresh-inoculated cattle, travelling from one end of the Australian Continent to the other, came on their road in contact with other herds that were not inoculated? Well, they would no doubt give a fair chance to these to contract pleuro-pneumonia, which had not existed there before, and the

latter herds, in their turn, or at least the vaccinated members of the same, would repeat the same play.

It might seem as if I am somewhat exaggerating, by reporting things which are not yet actually demonstrated ; but I only state here what we want to know with certainty ; and the importance of the whole question of protective treatment requires us to take an unprejudiced view of it. When the Netherlands Government introduced inoculation for the disease, they ordered the inoculated cattle to be isolated for some time, thus preventing their mixing so soon with others not inoculated ; everybody admits that this was a wise act, and people at that time knew about protection against pleuro-pneumonia not much less than they do now-a-days. Whether the scheme adopted by the Netherlands, could with advantage be imitated by Australia, I cannot tell.

Finally it is an acknowledged fact that, when the plague has appeared in a herd, and inoculation has to be resorted to, owners often experience difficulties in finding the proper *vaccin*, in preserving it for some time, or by lacking the manual skill required for performing the operation. Thus consequences may result, as they in fact do, which were not intended. The story of tailless cows and oxen is too well-known to Australians to need its relation on this occasion. It simply shows how miserably a measure, otherwise and in itself of a harmless nature, can be abused in the hands of ignorant persons, who may even do more harm by imparting diseases, *e. g.* tuberculosis, to originally quite healthy animals. Although, in my opinion, not too much weight ought to be attached to this obstacle in the practice of inoculation, because care and experience can reduce it to a minimum, yet the whole procedure is, from the above reason alone, liable to become discredited in the same way as human vaccination has been, and is still to some extent, discredited by the very fact, that it has been occasionally the means of introducing a host of anything but desirable skin and other diseases.

Let us now briefly review what has been dealt with above. We see that, on the one side, a majority of men and countries advocate

and encourage protective inoculation for pleuro-pneumonia ; while on the other side, by analysing its proper nature, we cannot admit of its being free from objections. These are partly, as has been shown in the foregoing lines, of a serious character, and thus by no means compatible with the verdict given by that majority. But I repeat distinctly that the objections raised relate to the protective arrangement such as it is found to exist at present. One thing is clear. The prophylactic measures employed in one country against the invasion of animal-plagues need not necessarily be the same in others, and what may be the case with the treatment of bovine pleuro-pneumonia in one part of the earth, need not hold good for that adopted in another one. Countries in which the disease is little prevalent, the relative number of cattle inconsiderable or at least where large herds do not exist, and where, I may add, the means of communication, as for instance railway traffic, are well-developed, may reasonably arrest the spread of the disorder by the " stamping-out system," and subsequent sanitary measures. But to adopt this system in Australia would be absurd, nor could or would its most tenacious defender recommend its being applied here, as things now are. It has been tried in Australia, with what success you may perceive by looking at the prevalence of the plague for the last years. If at present such a system was adopted here, which means not only the destruction of the infected individuals, but also a wholesale slaughter of all those which have been exposed to these, it would be equivalent to the loss of half the present stock of cattle.

Even then the measure would turn out to be utterly futile, unless the whole of the Continent acted in a uniform manner, and then again there will be no full guarantee of success until the origin and spread of the disease is traced beyond every doubt. At all events the colony of Queensland has done well by admitting that a reform in the way of protective means against lung-plague of cattle is absolutely necessary, and it is also easily understood that, as a preventive treatment by means of a *rational* inoculation seems to promise good results, the principal attention has been directed to this point.

The whole question, then, amounts to this. The necessary steps will have to be taken for a thorough investigation of the subject, in order to place it on a more scientific basis. What has already been done in this direction is scarcely more than a mere beginning, and a great many more experiments will have to be made, until we are entitled to say the etiology of the disease is as clearly known as, for instance, that of *anthrax*, and the question of protective inoculation against the disease regarded as solved. The present movement here and in Queensland evidences that these countries have come to the conviction that they will have to go and follow up their own way, instead of waiting till other countries are pleased to lay the desired remedy before them.